

What is claimed is:

1. A process for preparing 3-pentenenitrile, characterized by the following process steps:
  - (a) reacting 1,3-butadiene with hydrogen cyanide over at least one catalyst to obtain a stream 1 which comprises 3-pentenenitrile, 2-methyl-3-butenenitrile, the at least one catalyst and 1,3-butadiene,
  - (b) distilling stream 1 in a column to obtain a high-1,3-butadiene stream 2 as the top product and a low-1,3-butadiene stream 3 as the bottom product which comprises 3-pentenenitrile, the at least one catalyst and 2-methyl-3-butenenitrile,
  - (c) distilling stream 3 in a column to obtain a stream 4 as the top product which comprises 1,3-butadiene, a stream 5 which comprises 3-pentenenitrile and 2-methyl-3-butenenitrile at a side draw of the column, and a stream 6 as the bottom product which comprises the at least one catalyst,
  - (d) distilling stream 5 to obtain a stream 7 as the top product which comprises 2-methyl-3-butenenitrile, and a stream 8 as the bottom product which comprises 3-pentenenitrile.
2. The process according to claim 1, wherein the reaction in process step (a) is carried out over a homogeneously dissolved nickel(0) catalyst which is stabilized with phosphorus ligands.
3. The process according to claim 2, wherein the phosphorus ligands are selected from the group consisting of phosphines, phosphites, phosphinites and phosphonites.
4. The process according to any of claims 1 to 4, wherein the high-1,3-butadiene stream 2 from process step (b) is recycled at least partly into process step (a).
5. The process according to any of claims 1 to 4, wherein, in process step (c), stream 6 is obtained via the bottom with a concentration of 2-methyl-3-butenenitrile which is lowered in comparison to stream 5, the lowering being based on the ratio of the concentrations of 2-methyl-3-butenenitrile to trans-3-pentenenitrile.

6. The process according to any of claims 1 to 5, wherein stream 6 from process step (c) is recycled at least partly into process step (a).
- 5 7. The process according to any of claims 1 to 6, wherein stream 4 from process step (c) is recycled at least partly into process step (a) and/or (b).
8. The process according to any of claims 1 to 7, wherein stream 5 is withdrawn in vaporous form at the side draw in process step (c).
- 10 9. The process according to any of claims 1 to 8, wherein stream 1 is transferred directly to process step (c) with exclusion of process step (b).
10. The process according to any of claims 1 to 9, wherein stream 7 from process step (d) is recycled at least partly into process step (a) and/or process step (b).
- 15 11. The process according to any of claims 1 to 10, wherein, in process step (c), there are from 1 to 50 distillative separation stages between the position of the side draw and the column bottom.
- 20 12. The process according to any of claims 1 to 11, wherein the proportion of 2-methyl-3-butenenitrile in the catalyst stream 6 obtained in process step (c) is from 0 to 5% by weight.
- 25 13. The process according to any of claims 1 to 12, wherein, in process steps (b) and (c), the bottom temperatures do not exceed 140°C.
14. The process according to any of claims 1 to 13, wherein the sum of the average residence times in the distillation apparatus in process steps (b) and (c) together is not more than 10 hours.